I CLAIM:

1. Endothermic catalytic reaction apparatus comprising:

a) a U-shaped flow through tubular reaction chamber disposed upright within a combustion chamber, and a catalyst contained within said reaction chamber for the conversion of hydrocarbon to industrial gases by reaction with steam; said reaction chamber having an upper portion, and there being a convection chamber extending about said upper portion to enhance the transfer of heat from combustion products in the reaction chamber, and

b) a radiant burner generally vertically disposed within the combustion chamber and having a gas permeable zone that promotes the flameless combustion of fuel and oxidant supplied to said burner in order to heat a metal fiber surface of the burner to incandescence for radiating heat to the reaction chamber; said radiant burner configured so that the angle of radiation is predominantly incident upon the surface of the tubular reaction chamber.

2. The combination of claim 1 wherein said tubular reaction chamber comprises a tube having outer diameter or diameters ranging from about ¾ inch to about 4 inches along the tube length.

3. The combination of claim 1 wherein said tubular reaction chamber is sized for creation of mass velocities ranging from 400 $lb/ft^2/h$ to 1500 $lb/ft^2/h$.

4. The combination of claim 1 wherein said catalyst in the tubular reaction chamber has average catalyst particle diameters ranging from 1/8 to 1 inch for producing gas pressure drops ranging from 1 psi to 8 psi during flow through the reaction chamber.

5. The combination of claim 1 wherein said tubular reaction chamber has a gas exit end temperature ranging from 1150°F to 1400°F when heated by said radiant burner, in operation.

6. The combination of claim 1 wherein said tubular reaction chamber has legs and an arc-shaped bend connecting said legs, and said legs and bend have maximum tube wall temperatures ranging from 1300°F to 1600°F when heated by said radiant burner, in operation.

7. The combination of claim 1 wherein said tubular reaction has average heat fluxes ranging from 3,000 btu/ft^2/h to 10,000 btu/ft^2/h, when heated by said radiant burner in operation.

8. The combination of claim 1 wherein said tubular reaction chamber is sized to have capacity to generate hydrogen plus carbon monoxide product in volumetric quantities ranging from 50 SCFH to between 500 and 1500 SCFH.

9. The combination of claim 1 wherein said radiant burner comprises a supported porous ceramic material having extended life at operating temperatures up to 2100°F.